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HEIGHT ADJUSTABLE REVERSING CLASP FOR SAFETY BELTS OF MOTOR VEHICLES
[Höhenverstellbarer Umlenkbeschlag für Sicherheitsgurte von Kraftfahrzeugen]

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This invention relates to a height-adjustable reversing clasp for safety belts in motor vehicles having a longitudinally movable sled-like part, which may be latched in various positions, in or on a rail held fast by the vehicle, that carries the reversing clasp and having a flexible tension and/or pressure member, which transfers an adjustment motion derived from the seat adjustment onto the sled-like part.

Height-adjustable reversing clasps of this kind are known in various forms and they serve to adjust the upper fixed point, for example, of a so-called three-point safety belt to the height of the person who is to be secured.

Since the seat, mainly the driver's seat, is adjusted to the height of the person using the vehicle by longitudinal displacement and possibly by adjusting the inclination of the seat, it is common to link the height adjustment of the reversing clasp to the adjusting motion of the seat in such a way that a height adjustment of the reversing clasp is coordinated with the seat adjustment to correspond approximately to the size of the person being secured.

In a height-adjustable reversing clasp of the type mentioned at the outset described in DE-OS 37 13 137, the sled-like part is connected to the seat by a cable or Bowden cable in such a way that an adjustment motion of the seat is immediately transferred to the sled-like part, whereby the difference in adjustment paths between the reversing clasp and the seat is compensated by a tensioning

spring connecting the cable to the fixed point on the seat. However, such a coupling between the adjusting motion of the reversing clasp and the seat fails to produce satisfactory adjustment of the reversing clasp to the height of the person to be secured, since the required adjusting motion for adjusting the reversing clasp is not proportional to the adjustment path of the seat and since the adjustment is only very rough when the different adjustment paths are compensated by a spring.

It is also known to convert the adjusting motion of the seat to the height adjustment of the reversing clasp by means of a gear, whereby a suitable reduction ratio is then used to adapt the length of the adjusting motion of the seat to the shorter adjusting motion for the height adjustment of the reversing clasp. Ultimately, such couplings between adjusting movements are also unsatisfactory, since they always assume a proportionality between the adjusting movements, as well.

The present invention is based on the realization that there is no proportionality between the adjusting movement of the seat and the height adjustment of the reversing clasp. Moreover, in the front region of the adjusting movement of the seat no change in the height of the reversing clasp is required, while an adjustment of the height is needed in the middle region of the adjusting movement. In the region of a seat pushed to the back, on the other hand, there is once again no need for any additional height adjustment. In the middle

region of the seat adjustment, the relationship between the adjusting motion of the seat and the height adjustment of the reversing clasp should approximately follow a flattened S-shaped curve. This type of relationship between the adjustment of the seat and the height adjustment of the reversing clasp is due to the anatomy of people of different sizes, namely that smaller and larger people differ more in the length of their legs, so that they have essentially the same seat height. Statistically, with people of average height the seat height is more noticeable because of their different torso lengths, which follow a flat S-shaped curve.

Thus, the object of this invention is to create a height-adjustable reversing clasp of the type mentioned at the outset, whereby the height adjustment can be made as a function of the seat position, based on the statistically determined ideal curve.

In accordance with this invention, this object is achieved with a reversing clasp of the generic type, by providing a guide fixed to the seat or chassis with a curve characteristic that corresponds to the desired height adjustment of the reversing clasp as a function of the displacement path of the seat and a follower member, controlled by the guide, which is connected to the flexible tension or pressure member. Thus, with the novel height-adjustable reversing clasp, the adjusting motion of the seat is utilized by means a selectable curve for height adjustment of the reversing clasp, so that any desired adjustment characteristic can be selected. Thus, because of the

selected curve, the front region of the adjusting motion of the seat can result in little displacement of the sled-like part, while height adjustment only in accordance with a predetermined curve occurs in the middle region of the seat adjustment. When the seat is pushed far back, the curve can be selected once again so that no additional height adjustment of the reversing clasp occurs.

If the guide rail for the sled-like part that carries the reversing clasp is located on the B-pillar of the vehicle, then the guide is provided on the seat. On the other hand, if the guide is in the seat back, then the guide is provided on the car body.

The sled-like part is locked in the respective height in a conventional manner and, thus, this will not be described here.

An adjusting device consisting of the control curve and the follower member is suitably provided, having two guides, guide surfaces, or guide edges running essentially in the direction of seat adjustment, on which there are two elements that can roll or glide relative to each other, whereby the flexible tension and/or pressure element is attached to one element and the other forms an abutment, such that the flexible element extends outward or inward in its transverse direction corresponding to the distance of the guides or guide surfaces or guide edges, whereby the changing distance of the guides is made in accordance with the adjustment characteristic for the height adjustment of the reversing clasp and whereby the tension and/or pressure member forming the guides or the abutment are fixed

to the vehicle and the other moving part is adjustable along with the seat. One guide, guide surface, or guide edge suitably runs parallel to the direction of motion of the seat adjustment, so that the course of the other guide relative to the parallel surface corresponds to the desired setting characteristic.

The guides can be provided in a frame-shaped or plate-shaped part.

The elements that sense the guide edges of the two curves and that move relative to each other can be connected to each other by a yoke-shaped part or they can be made out of piece of tubing, in which a rod-shaped part, having a sliding block or guide roller on its free end, is longitudinally movable.

The sled-like part may be acted on by a spring in the direction of its lower position and the flexible element may consist of a Bowden cable, the lower end of whose tube-like jacket holds the abutment and the lower end of whose core is connected to a sliding block or sliding roll.

The flexible element can also be made to transmit a pull or push, whereby the movable elements are fixed in their guides transverse to their adjustment direction.

In the embodiments described above, the adjusting motion of the reversing clasp for adjustment to the height of the person being secured is performed as a function of the seat adjustment, in accordance with a predetermined characteristic curve. However, this

characteristic curve is not adapted to the particular height of a certain person. For this reason, in a further development of this invention adaptation by manual actuation of an adjustment device for individual height adjustment of the reversing clasp is also possible. This manually actuated adjustment device for individual adjustment of the reversing clasp can be made in such a way that the frame-shaped or plate-shaped part provided with the guides is pivotably mounted on the seat or on a part fixed to the chassis and it is provided with a manually actuated adjustment device for pivoting it. The frame-shaped or plate-shaped part can also be mounted so as to be movable transverse to the guides and be provided with a manually actuated adjustment device for imparting translational motion to it. By pivoting or shifting the part that holds the guides, an adjusting motion is directly transferred to the reversing clasp, so that the latter is also manually adjusted in accordance with individual needs.

If manual adjustment of the reversing clasp is made, it is desirable if this can be reversed quickly, for example if people of a different size use the vehicle. Thus, in an advantageous embodiment of the invention the manual adjustment device can be uncoupled from the guide or from the frame-shaped or plate-shaped part and the latter restored to its initial position by a spring, in which the adjustment device is then recoupled, in order to refasten the guide or the frame-shaped or plate-shaped part. The adjustment device can be a spindle drive with a half-open nut, so that the spindle can be

lifted out of the spindle nut and, after being pivoted or pushed back into its initial position, the guide can be inserted back onto the nut, so that the coupling spindle drive is restored, for fixing the guide and for activating the manual adjustment device.

If the seat back is pivoted from its typical riding position back into a resting position, a corresponding adjustment of the reversing clasp is needed in order to prevent the safety belt from passing by the neck region in an annoying manner. Thus, in a further development of the invention the seat back is coupled by geared means or control curves to the frame-shaped or plate-shaped part or to the guide in such a way that, once a predetermined angle is surpassed, the latter is pivoted or moved. In order to eliminate this pivoting or moving again, once the seat has been pivoted forward out of the resting position, the seat back can restore the guide or the frame-shaped or plate-shaped part to its normal position, once a predetermined forward pivoting motion has been exceeded.

In a further development of the invention, a servo motor is provided for adjusting the sled-like part that carries the reversing clasp, whereby a sensor controlled by the seat and/or the seat-back adjustment is provided, which controls the servo motor in accordance with the desired adjustment characteristic. The conversion of the adjustment motion in accordance with a predetermined curve into electrical signals, which then control the servo motor, renders complex mechanical transmission mechanisms unnecessary, so that

adjustment of the reversing clasp can be adapted to the particular requirements. The servo motor can also be actuated for individual height adjustment of the reversing clasp.

Embodiments of the invention will be explained below with the help of the drawing. It shows:

Figure 1: a schematically depicted perspective view of a vehicle seat with a reversing clasp arranged beside it on the B-pillar of a vehicle, vertically adjustable in a guide rail;

Figure 2: a perspective schematic representation of the height adjustment of a reversing clasp by a flexible member that transmits pulling and pushing forces as a function of the seat adjustment;

Figure 3: a representation corresponding to figure 1, in which the guide for individual manual height adjustment of the reversing clasp is also pivotable;

Figure 4: a representation corresponding to Fig. 3, in which the axis of rotation of the guide is in its front region;

Figure 5: a representation corresponding to Fig. 3, in which the guide for individual manual height adjustment of the reversing clasp is movable in the transverse direction;

Figure 6: a representation corresponding to Fig. 4 with a schematic indication of the adjustment device consisting of spindle drives; and

Figure 7: a schematic representation of the spindle nut, which can be lifted out.

Figure 1 shows schematically a seat **1** with a seat back **2** pivotably mounted to it. The seat is movable in the longitudinal direction in a conventional manner on rails (not shown) fixed in place on the chassis and lockable in various positions on the seat rail.

On the B-pillar of the vehicle, a schematically indicated U-shaped guide rail **3** for a sled-like part **4** is attached, which is articulated connected to reversing clasp **5** of safety belt **6**. Thus, reversing clasp **5** forms the upper fixed point of the only partially indicated three-point safety belt.

The sled-like part **4** which carries reversing clasp **5** is acted on by a tension spring **7** in the direction of its lower position. For moving sled-like part **4** in guide rail **3** a cable **8** is provided that passes over corner pulleys and/or guides (not shown) and that is guided at least part way in a tubular part **10**, such as the flexible jacket of a Bowden cable, made of coiled wire.

The seat has on it a guide curve **12**, in which a sliding block or roller runs, which is connected to the front end of flexible cable **8** at point **13**. Guide tube **10** is fixed in place on the chassis, whereby the front end of flexible cable **8** sufficiently stiff that when it slides along guide curve **12** during seat adjustment it moves only in the longitudinal direction, but remains essentially unbent.

Guide curve **12** has the shape of a flat S so that, depending on the characteristic of the curve, over the entire adjustment path X of

the seat the movement of the reversing clasp results only in an adjustment path Y. The characteristic of curve **12** is selected such that at the beginning and end of the seat adjustment there is no adjustment of sled-like part **4**. Only in the middle region is there any height adjustment of reversing clasp **5**, in accordance with the curve characteristic.

In the embodiment in Fig. 2, flexible part **15** is made of an element that transfers tension and pressure forces, so that there is no need for spring tension on sled-like part **4**.

It may be seen in Figs. 1 and 2 that, in accordance with the curve characteristic which makes possible an adjustment path of flexible element **8, 15** over the distance Y, a height-adjustment path Z of sled-like part **4** is derived. Basically, the exemplary embodiment in Fig. 3 corresponds to the embodiment in Fig. 1. However, in order to allow individual height adjustment of sled-like part **4** with reversing clasp **5** independent of the characteristic of curve **12**, the plate with curve **12** is pivotable about vertical axis **20**. A schematically indicated manually actuated adjusting drive **21** is provided for pivoting the curve plate. This adjusting drive can be used to pivot the plate with curve **12** in the direction of double arrow **22**. Thus, in addition to height adjustment by means of curve **12**, reversing clasp **5** can be adjusted by actuation of hand wheel **21**.

The embodiment shown in Fig. 4 is basically the same as in Fig. 3, but axis of rotation **24** is changed to the front end of the plate

with curve **12**, while adjusting drive **25** is at the back end of the plate.

In the embodiment in Fig. 5, plate **30** with curve **12** is adjustable in the transverse direction in parallel guides **31, 32**, indicated by the dot-dashed lines. A manually actuated adjusting drive **34** approximately in the center of curve plate **33** is provided for moving the curve plate in the direction of double arrow **33**.

The embodiment in Fig. 6 is similar to the one in Fig. 4, but the adjusting drive consisting of a spindle drive is also indicated schematically. Plate **40** with curve **12** is pivotable by spindle drive **41** about vertical axis of rotation **24**. Curve plate **40** is acted on by tension spring **43** in the direction of an end stop that is fixed in place on the seat. By actuating hand wheel **45** of the spindle, the curve plate can be pivoted, as indicated by double arrow **46**.

As schematically indicated in Fig. 7, spindle nut **48** is provided with a slotted hole groove **49**, the flanks of which are provided with threads, which mesh with the threads of spindle **50**. By lifting spindle nut **48** in the direction of arrow **51**, the connection between spindle and spindle nut is disconnected, so that plate **40** under the influence of tension spring **43** is pivoted back into its initial position. In this position, the connection between the two is then restored by pushing spindle nut **48** onto spindle **50**, so that curve plate **40** is locked in its initial position.

While known mechanical transmission systems permit only a height adjustment of the reversing clasp that is direct or derived from the adjusting motion of the seat by a gear, with the present invention there is a height adjustment of the reversing clasp to the seat adjustment that corresponds to the ideal adjustment.

It is particularly advantageous that the novel adjusting device also permits manual adjustment of the reversing clasp for individual adjustment to the body size of the person being secured.

During height adjustment in accordance with this invention, if the vehicle seat is moved in the longitudinal direction, a driver slides on the guide rail, which is firmly attached to the movable elements of the seat. Due to the curve characteristic, the driver passes through the curve in the X-direction of the X-Y-plate shown. Thus, the driver travels a path in the Y-direction corresponding to the characteristic of the curve. Depending on the direction of motion of the seat, the driver is pulled and/or pushed, so that the sled-like part moves by an amount Z with respect to the height adjustment.

With the novel adjusting device, any desired adjustment of the reversing clasp along the adjustment path can be selected, in accordance with the characteristic of the curve.

The guide rail of the curve can have any suitable cross section. For example, the guide can consist of a bar on which a ring slides that is connected to the flexible element. Instead of a ring, a

follower member that encloses the bar in a U-shaped or forked manner can be provided.

The guide can also consist of a C-shaped hollow section in which a sliding block or roller runs, whose holding part passes through the slot and outward.

The guide can also consist of a T-shaped profiled rail that is provided with a sliding shoe that encloses it in a C-shape.

The rotary adjustment or translational adjustment in the transverse direction of the guide can occur by means of suitable adjusting means, but preferably by means of a spindle. The guide rail is spring loaded, so that once the adjusting drive is released it is always returned to its basic position. If the adjusting drive consists of a spindle, then it can easily be released if the spindle nut consists of a half-open nut.

Claims

1. A height-adjustable reversing clasp for safety belts in motor vehicles

having a longitudinally movable sled-like part that is guided in or on a rail fixed in place on the vehicle, that is latchable at positions at various heights, and that carries the reversing clasp, and

having a flexible tension and/or pressure member that transmits an adjusting motion derived from the seat adjustment to the sled-like part, characterized in that,

a guide is provided that is fixed to the seat or chassis with a curve characteristic that corresponds to the desired height adjustment of the reversing clasp as a function of the displacement path of the seat, along with a follower member, controlled by the guide, whish is connected to the flexible tension or pressure member.

2. A reversing clasp as recited in Claim 1, characterized in that an adjusting device comprising the control curve and the follower member are provided that has two guides, guide surfaces, or guide edges, extending essentially in the adjustment direction of the seat, on which two elements that roll and/or slide with respect to each other are guided, that on one element the flexible tension and/or pressure element is mounted and, thus, forms an abutment for the other, that the flexible element moves in or out it its transverse direction in accordance with the distance between the guides, guide surfaces, or guide edges, that the changing distance between guide surfaces or guide edges is made to be commensurate with the desired adjustment characteristic of the height adjustment of the reversing clasp, and that the guides, guide edges, or guide surfaces or the element forming the abutment is held is fixed in place on the vehicle and the other movable part is adjustable along with the seat.

3. A reversing clasp as recited in Claim 1 or 2, characterized in that a guide or guide surface or guide edge extends parallel to the direction of the seat adjustment and the course of the other guide corresponds to the desired adjustment characteristic.

4. A reversing clasp as recited in one of the Claims 1 through 3, characterized in that the guides are provided on a frame-shaped or plate-shaped part.

5. A reversing clasp as recited in one of the Claims 1 through 4, characterized in that the sled-like part is acted on by a spring in the direction of its lower position and the flexible element is a Bowden cable, the lower end of whose tube-like jacket holds the abutment and the lower end of whose core is connected to a sliding block or sliding roll.

6. A reversing clasp as recited in one of the Claims 1 through 5, characterized in that the flexible element is made for transmitting a pull or a thrust and the movable element is mounted in guides transverse to its adjustment direction.

7. A reversing clasp as recited in one of the Claims 1 through 6, characterized in that the frame-shaped or plate-shaped part with the guide(s) is pivotably mounted on the seat or on a part that is fixed in place on the chassis and is provided with a manually actuated adjusting device that pivots said part.

8. A reversing clasp as recited in one of the Claims 1 through 6, characterized in that the frame-shaped or plate-shaped part with the guide(s) is movably mounted transverse to the guide(s) and is provided with a manually actuated adjusting device for transverse displacement.

9. A reversing clasp as recited in Claim 7 or 8, characterized in that the manual adjusting device is removable from the frame-shaped or plate-shaped part and the latter is acted on by a spring in the direction of its initial position, in which the adjusting device is recoupled.

10. A reversing clasp as recited in one of the Claims 7 through 9, characterized in that the adjusting device is a spindle drive with an approximately half-open nut.

11. A reversing clasp as recited in one of the Claims 1 through 10, characterized in that the seat back is connected to the frame-shaped or plate-shaped part in such a way that, after exceeding a predetermined rotational angle, the seat back pivots or moves said part in order to transmit an additional adjusting motion to the sled-like part.

12. A reversing clasp as recited in Claim 11, characterized in that the coupling between the seat back and the part that is provided with the control curve is disconnected once the seat back has exceeded a predetermined forward rotational motion.

13. A height-adjustable reversing clasp, characterized in that a servo motor is provided for adjusting the sled-like part and that sensors are provided that are controlled by the seat and/or seat back adjustment and that control the servo motor with the desired adjustment characteristic for the reversing clasp.

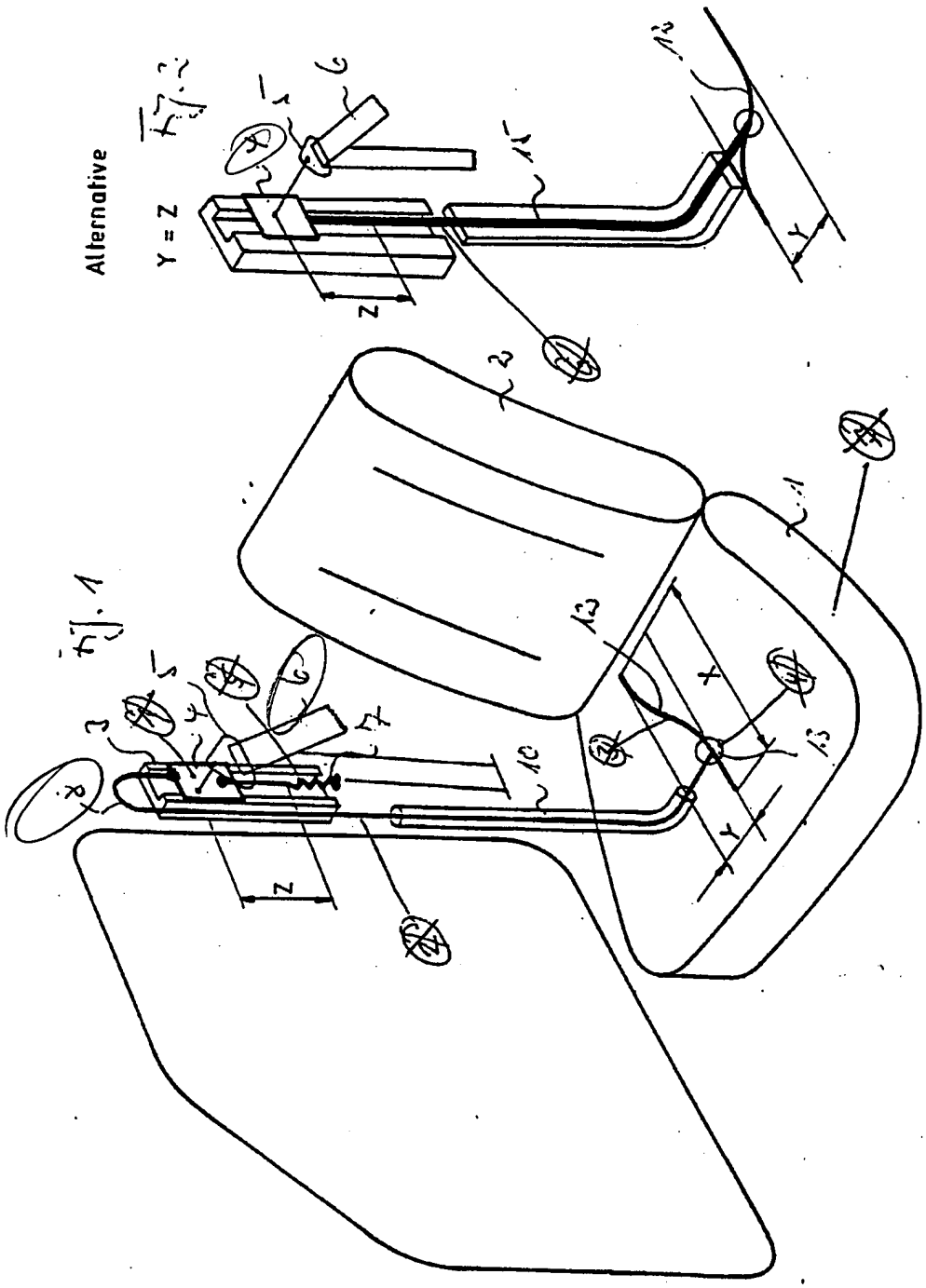
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Fig. 2
Fig. 1
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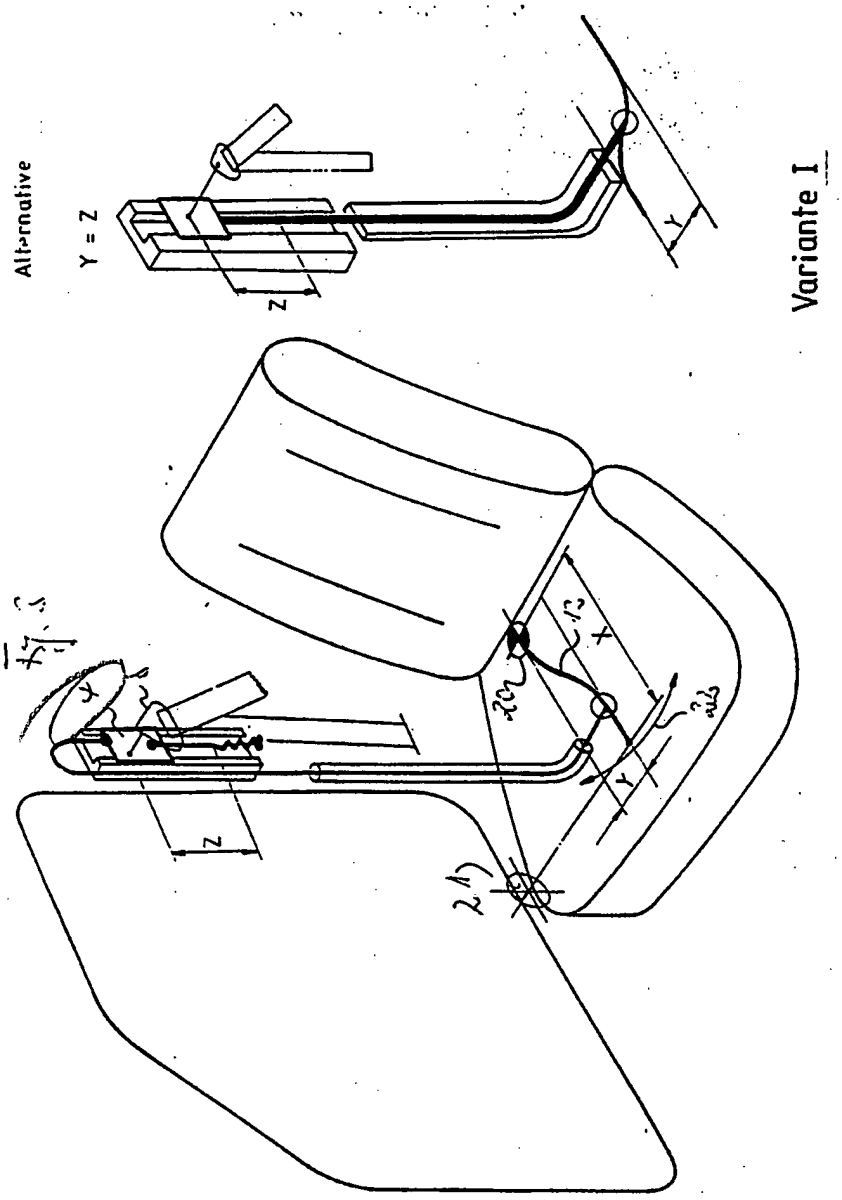
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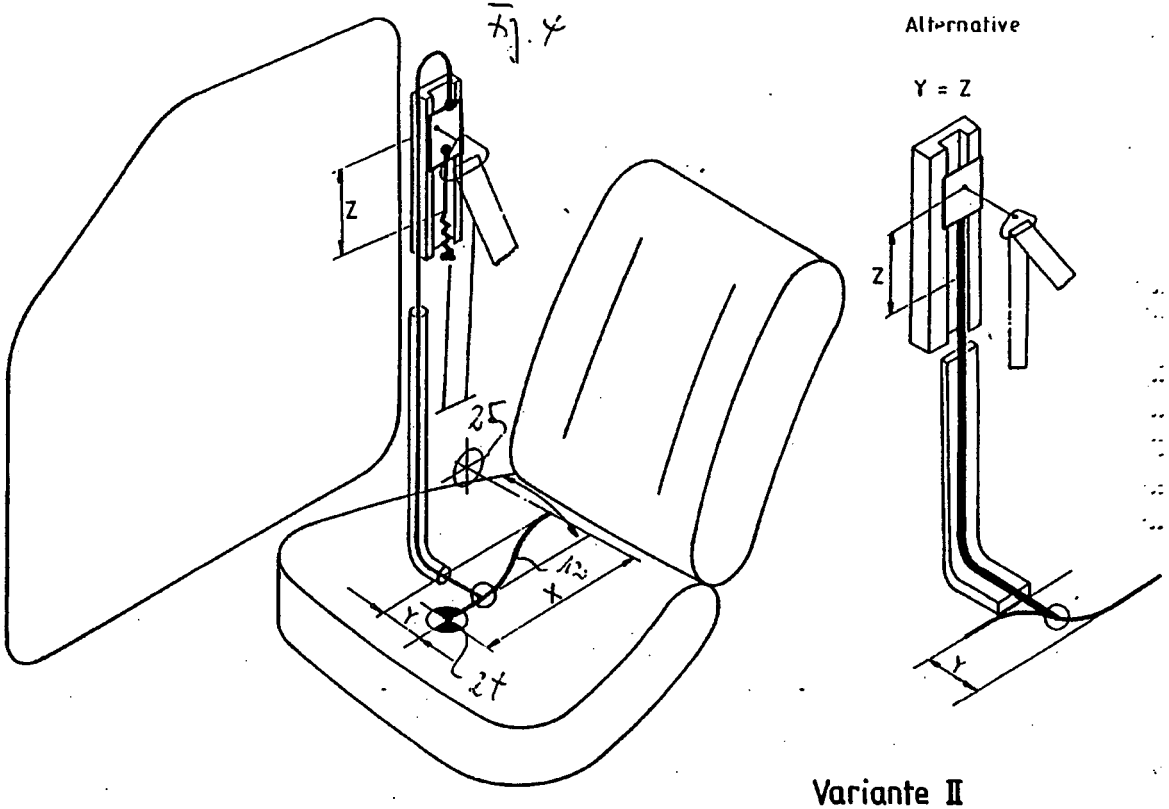

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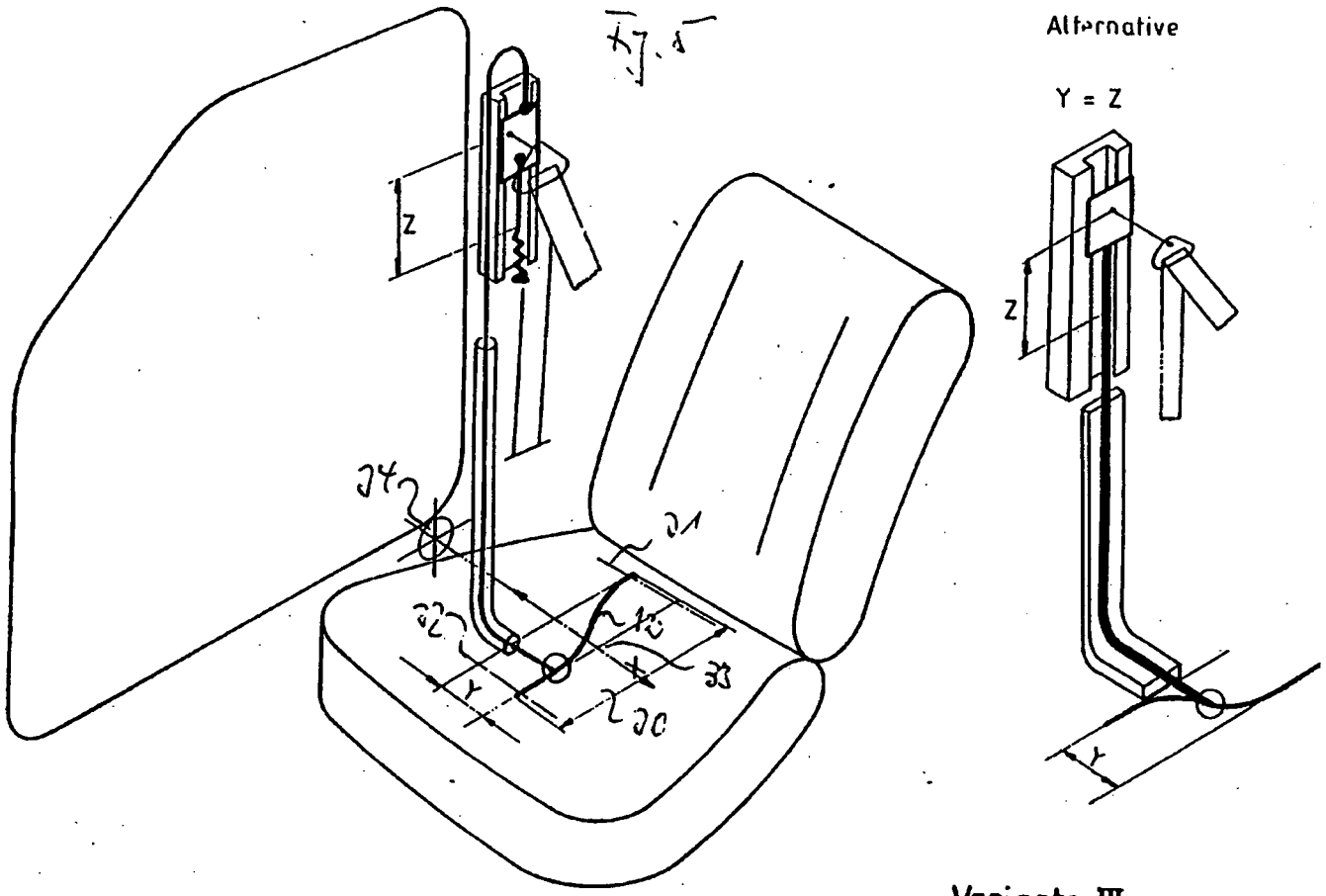

Variante III

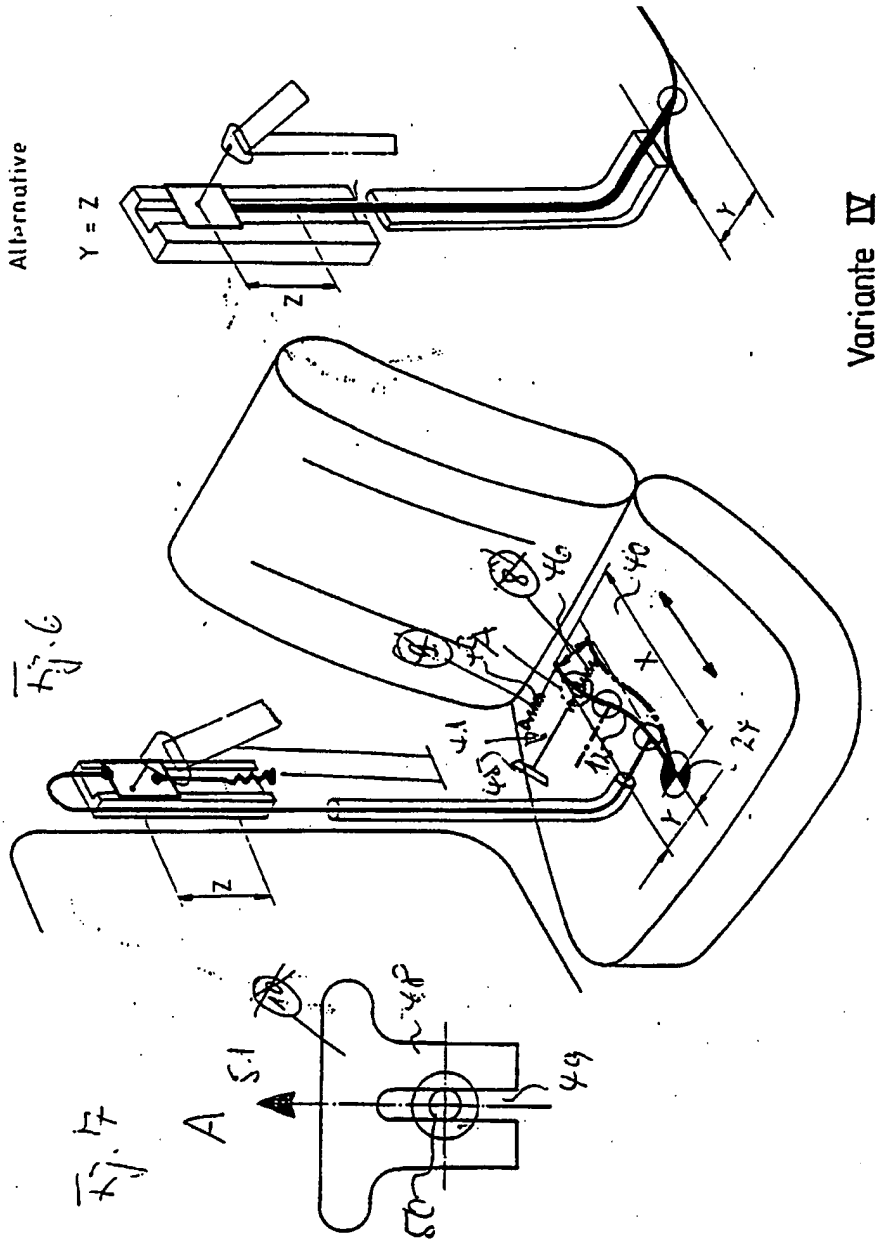
Alternative
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Fig. 6
Fig. 7
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